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SOIL CONSERVATION SERVICE

LAND RESOURCE AREAS TEXAS

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LAND RESOURCE AREA DESCRIPTIONS

See Land Resource Area Map Following Page 29

A land-resource area is "a geographical area of land, at least several thousand acres in extent, characterized by a particular combination or pattern of soils including slope and erosion, climate, water resources, land use, and types of farming. Such a unit may occur in one continuous area or in segments."

The Coast Prairie Area

The Coast Prairie includes the nearly flat strip of country that borders the Gulf Coast in southeast Texas in the humid zone. It ranges from about 30 to 80 miles in width and extends along the coast from the Sabine River in Orange County to about the San Antonio River in Victoria County, a distance of about 250 miles. The total area of the Coast Prairie is about 7,500,000 acres. The flat prairie west of the San Antonio River, which is a continuation of the Coast Prairie, is included with the Rio Grande Plain because of the similarity of climate, vegetation and other features. A small area in the extreme southeastern part is designated as the Coast Marsh. The Coast Prairie is only slightly dissected and drainage is deficient in many parts. The native vegetation is coarse grasses, mainly species of andropogon, paspalum and panicum, with a narrow fringe of trees along the streams. Narrow strips of marsh occur in places adjacent to the coast line.

The soils of the Coast Prairie have developed from parent materials of deltaic and lagunal deposits laid down in fresh water as the Gulf receded. These deposits are of two kinds: calcareous clays and clay loams near the coast, and slightly acid more sandy materials in the more inland parts. The soils of each part differ considerably and largely reflect the character of the parent materials and drainage conditions under which they have developed. The surface for several miles inland from the coast is flat and nearly level. Dissection is incomplete and streams have very shallow channels. Much of this part is so flat or slightly depressed that natural drainage is deficient and ditching for drainage is needed for most crops except rice. In the interior part the surface is gently undulating, the soils are more permeable and drainage is nearly everywhere adequate for all cultivated crops.

The principal soils near the coast are of the Beaumont, Lake Charles, Bernard and Edna series. These are dark gray to black clay loam to clay soils with nearly level surfaces and slow to very slow drainage. Most areas need some artifical drainage for best yields of row crops. These soils occupy about 4,840,000 acres.

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In the more inland part, the principal soils are of the Hockley, Katy and Kenney series. These are grayish brown to light brownish gray friable sandy loams with subsoils of clay loam to sandy clay. They occupy nearly level to gently sloping surfaces and are sufficiently well drained for crop use without artificial drainage. These soils occupy an area of about 1,760,000 acres.

Many soils in the more humid portion of the Coast Prairie require drainage for improved pasture.

There are important areas of alluvial soils in the flood plains of the larger streams and rivers that cross the Coast Prairie. These are mainly of the Trinity and Kaufman series in the eastern part and Miller, Pledger and Norwood series in the central and western parts. These soils occupy a total of about 900,000 acres.

Erosion is of minor importance in the Coast Prairie because of the nearly level surfaces. Drainage and soil management to maintain or improve fertility and increase organic matter and soil structure are the major conservation requirements.

The principal cultivated crops are rice,cotton, corn and sorghum. Adapted pasture and meadow plants are Dallis, Bermuda, Rhodes, little bluestem, rye, rescue, blue panic, switch, Indian, Angleton bluestem, King Ranch bluestem and seacoast bluestem grasses, white clover, common and Kobe lespedeza, yellow hop, persian, Ladino, Louisiana red and hubam clovers.

The Coast Marsh Area

The Coast Marsh includes a narrow strip of wet lowland adjacent to the coast. The principal part lies east of Galveston Bay, but narrow fringes occur along the entire length of the coast. The total area is about 500,000 acres. The surface is at or only a few feet above sea level. Part of this section is

covered at times by salt water blown from the Gulf during storms. The water table is at or near the surface most of the year and the soils are saturated except for short periods during the dry season, usually August to November The vegetation is water tolerant grasses, sedges and salt grass.

Some soils of the Coast Marsh are well suited for muskrats and other wildlife.

The soils have little development and represent the two extremes in soil textures. Harris clay, a gray mottled wet dominantly clay soil, is the principal series. Galveston sand, a deep loose nearly white sand, occupies narrow beaches, low sand ridges and bars in the Gulf. The Harris soils occupy low flat areas that merge with the tidal marsh, and most areas are salty. A few small areas have been diked, drained and used for rice production, but the best use for these soils is for grazing. Marsh or marshland, is covered with water most of the time and supports a thick cover of sedges, rushes and cattails. Both fresh water and salt water marsh occur in the area. Marsh is suited only for grazing by cattle and for wildlife.

East Texas Timberlands Area

The East Texas Timberlands comprises the forested eastern part of the state, an area of about 25,000,000 acres. This is a gently rolling to hilly well dissected mostly well drained area although some flat areas on stream divides and in the flatwoods section in the southern part have poor drainage. The vegetation in the eastern part is mainly pine with an understory of hardwood trees, mainly oak, gum, elm and some hickory. In the western part, locally

called the Post Oak Belt, the vegetation is mainly hardwood trees, mostly post oak, blackjack and elm with some pine in places.

Pine is primary vegetation with understory of hardwoods in eastern part of Timberlands area.

Post oak, blackjack and elm trees predominate in western part of Timberlands area.

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The soils are mostly light colored fine sandy loams and loamy sands with subsoils that range from loamy sand to plastic clay in texture and from yellow to red in color with or without mottling with other shades of red, yellow or gray. Parent materials are unconsolidated beds of acid sandy loams to sandy clays and the soils are medium to strongly acid throughout. The soils are low to very low in all essential plant nutrients but are very responsive if properly fertilized and well managed. The principal soil series are Boswell, Bowie and Lakeland in the northern and central parts; Nacogdoches and Magnolia in the "Redlands" section; Lufkin, Tabor and Edge in the Post Oak Belt; and Caddo and Segno in the flatwoods section bordering the Coast Prairie. Alluvial soils occur in the narrow to wide strips in the flood plains of local and through flowing streams. These soils of bottomlands range from light colored acid find sandy loams to dark gray, calcareous clays. Where not too frequently flooded they are highly productive. It is estimated that the Boswell, Bowie and Lakeland soils occupy about 45 percent; the Nacogdoches-Magnolia soils about 6 percent; the Lufkin, Tabor and Edge soils about 26 percent; the Caddo-Segno soils about 12 percent and the alluvial soils about 11 percent of the entire Forested Timberlands area.

A high proportion of this forested area has been cleared and used for cropland at one time or another over a long period of years. Because of depleted fertility and soil loss by erosion, much of this once cultivated land has been reforested, either by natural reseeding or by planting, or is now used for pasture. The soils, if well managed, are suited for use in growing a wide variety of field crops, special and truck crops, vine and tree fruit. These include corn, cotton, sorghum for hay, lespedeza, cowpeas, peanuts, melons, tomatoes, pepper, okra, blackberries, dewberries, peaches, pears, and plums.

A high proportion of the East Texas Timberlands has been cleared and converted to improved pasture.

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Legumes for green manure include vetch, Austrian winter peas, Singletary or Caleypeas, crimson clover, crotalaria, kudzu and velvet beans. Adapted grasses and legumes for pasture or meadow include Dallis, common and coastal bermuda, carpet and vaseygrass, little bluestem, annual and sericea lespedezas, hop, white, crimson and red clovers, kudzu, burclover and black medic. Lime and phosphate fertilizers are needed for best growth of most legumes.

The East Cross Timbers

The East Cross Timbers include a long narrow strip of wooded soils that separate the northern parts of the Blackland and Grand Prairies. This strip is only a few miles wide and extends from the Red River southward into Hill County and includes a total area of about 1,090,000 acres. The soils are similar to those of the Post Oak Belt but occupy more rolling surfaces as a whole. They are mainly of the Tabor, Edge and Bowie series. These are light colored acid sandy soils with yellowish to mottled red and yellow subsoils of firm clay to sandy clay loam. They are of low inherent fertility and only a small total area has been cleared and cultivated. These soils are suited for growing about the same kinds of crops as those grown on soils of the Post Oak Belt. Cotton, sorghums, cowpeas, peanuts, vine and tree fruits are the most adapted crops.

The Blackland Prairies

The Blackland Prairies comprise the almost treeless areas of east central Texas wherein dark mostly clay soils are dominant. The main area, or Blackland Prairie Proper, occupies a long rather narrow strip that extends in a southwestern direction from near the Red River in northeastern Texas to Bexar County in the south central part of the state. Smaller areas, often referred to as minor prairies, occur in separate bodies in southeast Texas. These are intermixed with or extended into the Post Oak Belt. The total area of the Blackland Prairies is about 11,500,000 acres.

The general surface relief is undulating to gently rolling although it ranges from nearly level on some stream divides to strongly sloping. A well defined west-facing escarpment, the White Rock Escarpment, along the west side separates the Blackland Prairie Proper from the Grand Prairie to the west. Uplands bordering many of the streams have rather steep slopes in places. Along the east side a strip several miles wide with smoothly undulating to nearly level surfaces, often referred to as the Gray Prairie, separates the Prairie Proper from the East Texas Timberlands.

The native vegetation consists of bunch and short grasses. The main species are little and big bluestem, Indiangrass, buffalograss and threeawn. Scattered mesquite trees, cacti, and other shrubs form a rather thick cover in places. Hardwood trees, mainly elm, hackberry and pecan occur in stream bottoms.

The soils of the greater portion of the Blackland Prairie Proper are mainly of the Houston Black, Houston, and Austin series with smaller areas of Lewisville, Sumpter, and Eddy soils. The Austin and Eddy soils have developed from soft chalky limestone, Austin chalk, and are of medium to shallow depth. These are dark grayish brown to brown calcareous crumbly granular clay soils. The Houston Black and Houston clay soils have developed mainly from deep beds of highly calcareous clay, or marl. These are deep dark gray to nearly black

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Originally the Blackland Prairie had a cover of tall grasses with a few scattered trees, mostly along the drains. The larger bottoms had more timber growth.

calcareous clays that are crumbly when moist but very sticky and plastic when wet. Sumpter soils are of yellowish brown strongly sloping calcareous clays and Lewisville soils are of deep dark gray to brown calcareous clays on stream terraces.

The Crockett and Wilson soils have developed from slightly acid to weakly calcareous clays on level to gently sloping surfaces. These are moderately dark fine sandy loam to clay loam soils that are very tight and compact when dry. The surface of cultivated fields has a thin light gray crust on the surface when dry, hence the name "Graylands." Subsoils are of dark gray to mottled reddish brown and gray compact blocky clay. Trinity and Catalpa clay soils occupy the flood plains of streams in association with soils of the Houston Black and Austin soils. These are very dark gray to dark grayish brown calcareous mostly clay soils of high fertility. Where not too frequently flooded, they are farmed to general crops and are very productive. Kaufman clay and Gowen clay loam are the principal alluvial soils associated with the "Graylands." They are dark, slightly acid and moderately productive.

The approximate acreages are: Houston Black, Houston and Austin soils and associated alluvial soils about 6,800,000 acres, and Wilson and Crockett soils and associated alluvial soils about 4,700,000 acres.

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The soils of the Blackland Prairies as a whole are among the most productive upland soils of the state. However, because of the clay texture and sloping surfaces, they are very susceptable to erosion. Many areas have been severely damaged and some of the steeper slopes are so gullied that they are no longer suited for cultivation. The agriculture has been based around the production of cotton, with smaller acreages used for growing corn, small grains, grain sorghums and Sudan, Johnsongrass, sorghums and millet for hay. Soil improving crops include hubam clover, vetch, Austrian winter peas and biennial sweet clovers. Adapted pasture and meadow grasses include big and little bluestem, Indiangrass, sideoats grama and buffalograss. Many of the more sloping and eroded areas of these soils are being retired from cultivation and seeded or sodded to perennial grasses for pasture.

The Grand Prairie Area

The Grand Prairie includes the prairie area lying just west of the Blackland Prairie in northcentral Texas. It extends south from the Red River to about the Colorado River and comprises an area of about 6,500,000 acres. This is a high rolling well dissected limestone area with moderate to rapid surface drainage.

The southern part is the most rolling and hilly and contains a high proportion of stony shallow soils unsuited for cropland. The northern part contains a higher proportion of gently sloping to rolling deep soils well suited for cropland. The native vegetation is mainly short grasses with some mid and tall grasses on the deeper soils. Buffalo and gramagrasses, little bluestem, and Indiangrass are the most widespread. In many places, especially on rocky slopes of shallow soils, small oak and juniper trees form a thick cover, and scattered mesquite trees occur throughout this area.

Gently rolling Grand Prairie supports good range grasses.

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The soils have developed from limestone or marl with interbedded limestone. They are mostly calcareous crumbly granular clay soils that range from very shallow to deep. On the steeper slopes, the soils usually are dark grayish brown to brown and are underlain at depth of a few inches by limestone bedrock or a deep bed of limestone fragments over bedrock. In places bare rock is exposed and many large areas of strongly sloping to steep very shallow and stony soils occur. On smooth to gently sloping divides and in shallow valleys the soils are dark gray to dark grayish brown, deep and similar to soils of the Blackland Prairies.

The principal soils of the Grand Prairie are of the Tarrant, San Saba and Denton series. Small areas of soils of the Crawford, Brackett, Krem and Lewisville series occur also in the uplands and alluvial soils mainly of the Catalpa series occur in the flood plains of streams. The Tarrant soils are of dark gray to dark grayish brown calcareous clay 5 to 10 inches thick over limestone. Many areas are stony and all are too shallow for cultivation. San Saba soils are dark gray to nearly black mostly calcareous clays similar to Houston Black clay. They occupy nearly level surfaces, have slow surface and internal drainage and are very sticky and plastic when wet. Denton soils comprise dark brown to dark grayish brown crumbly granular calcareous clays. They range between about 10 and 36 inches thick over limestone or interbedded limestone and marl. They occupy gentle to moderate slopes, are less dark and have more rapid drainage than the San Saba soils. Crawford soils are reddish; Brackett soils are lighter colored than Tarrant but are very shallow also. Krem and Lewisville soils are similar to the Denton soils but are deeper and developed in unconsolidated materials. The Catalpa soils in the flood plains of streams are dark grayish brown crumbly granular calcareous clays and clay loams. The Tarrant and Brackett soils occupy about 45 percent; San Saba soils about 25 percent; and Denton and similar soils about 30 percent and the alluvial soils about 10 percent of the entire Grand Prairie area. Small and fairly large areas of soils suitable for cropland occur throughout the area, but the highest proportion is in the northern and eastern parts. A high percentage of the total area of the Grand Prairie, probably about 60 percent, is of shallow and stony soils unsuited for cropland.

The soils of the Grand Prairie, where not too shallow for cultivation, are suited for growing oats, wheat, cotton, grain sorghums, corn and other feed crops. Sweet clover, vetch and Austrian winter peas are used for soil improving crops. Adapted grasses for meadow or pasture are big and little bluestem, King Ranch bluestem, Indiangrass and switchgrass on the deeper soils, and sideoats grama and buffalograss on the shallow soils. Bermudagrass does well on deep soils, especially in bottomlands where moisture is favorable.

The West Cross Timbers

The West Cross Timbers area includes the wooded section west of the Grand Prairie in central north Texas. It extends from the Red River southward to the north edge of Brown County and includes a total area of about 2,675,000 acres. Small areas also occur intermixed or interlaced with soils of the western part of the Grand Prairie.

The surface relief ranges from gently rolling to strongly rolling with only small areas of gently sloping soils on broad divides. The area is well dis-

sected and has moderate to rapid surface drainage. Several large rivers; the Red, Brazos, and Colorado; and many small streams provide rapid drainage for the area as a whole. Deep gullies occur in many parts of the area and have essentially ruined a considerable portion for further crop use.

The native vegetation is mainly post oak and blackjack oak trees and a few other hardwoods. The trees are scrubby, of small size and unsuited for most uses other than firewood or fence posts. In places grasses, including little bluestem, grama and threeawn, and scattered mesquite trees form a thick ground cover where the oak overstory is thin.

Grasses furnish good grazing where oak overstory is thin in West Cross Timbers.

The soils have developed from deep beds of noncalcareous mostly sandy materials ranging from soft packsand to weakly indurated sandstone and sandy shale. The soils are mainly of sandy texture in the surface layers with subsoils of friable sandy clay loam to firm sandy clay or clay. These are light colored acid soils low in organic matter and of only low to moderate productivity. The principal series are Windthorst, Nimrod and Stephenville. Narrow areas of alluvial soils, mainly of the Gowen series, occur in the flood plains of local streams. Soils of the Miller, Yahola and Norwood series occur in the flood plains of the through flowing rivers. The Windthorst soils occupy about 45 percent, Stephenville soils about 20 percent, Nimrod about 15, the alluvial soils about 6 percent and other soils about 14 percent of the total area of the West Cross Timbers.

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The soils of this area are very susceptible to erosion and many areas are affected by moderate to severe sheet and gully erosion. A very high proportion was once used for cropland but much of it is now unsuited because of erosion.

Severe areas of erosion on old crop fields contribute serious sediment damage to valuable bottomlands in the West Cross Timbers.

Probably only about 40 percent is suited for cultivated crops. The best adapted crops are cotton, sorghums, vetch for seed, peanuts, truck crops and fruits on soils of the uplands and cotton, corn and sorghums on the bottomlands. Oats and wheat are additional crops on the finer textured soils and on included prairie areas. Soil improving crops include vetch, Austrian winter peas, sweetclover, cowpeas, crotalaria and rye for green manure. Alfalfa can be grown for hay in flood plains that are infrequently flooded for only short periods. Adapted grasses and legumes for pasture or meadow include little, big and King Ranch bluestem grasses, Indiangrass, sand and weeping lovegrass, rescuegrass, sideoats grama, switchgrass and wild ryegrass. Bermuda grows well on bottomlands and on sites with favorable moisture conditions.

The North Central Prairies

The North Central Prairies occupy an area of about 6,000,000 acres in central north Texas. The area lies between the West Cross Timbers and the Rolling Plains and is that heretofore often referred to as the Reddish Prairie. The area is dominantly prairie, but numerous small wooded areas are intermixed and the boundaries are not distinct.

The surface, for the most part, is undulating to gently rolling, but some rather large areas have nearly level to gently sloping or strongly sloping

surfaces. The area is well dissected and drainage is moderate to rapid in all but a few small nearly level areas. Native vegetation is mainly little bluestem, sideoats, hairy and blue grama, Indian and Buffalograss. Scrubby trees and shrubs, mainly post oak and mesquite, and cacti grow rather thickly in places.

Landscape - North Central Prairies.

The soils have developed from alkaline to weakly calcareous materials ranging from soft sandstone to sandy shale or shaly clay. They are mostly reddish brown to grayish brown fine sandy loams and clay loams with subsoils of mottled reddish or gray firm plastic clay. These are medium depth soils of about neutral reaction that are rather tight and crusty when dry. They are of only moderate fertility and crop yields are often limited by lack of moisture. On the steeper slopes, shallow and stony soils are common and usually support a thin stand of grasses and a moderate stand of scrubby hardwood trees.

The principal soils are of the Renfrow, Kirkland, Darnell and Zanies series. Narrow strips of alluvial soils, mainly of the Gowen and Catalpa series, occur in the flood plains of local streams. Small areas of other soils similar to those of the West Cross Timbers and Grand Prairie occur intermixed. Probably the Renfrow, Kirkland and Darnell soils together occupy about 75 percent of the area, the alluvial soils about 5 percent and soils of other series the remaining 20 percent of the total area of the North Central Prairies.

The soils are of moderate productivity when moisture is adequate, but summer droughts often reduce yields. The soils are crusty, dry to a hard dense mass, and absorb water slowly because of the dense claypan subsoils. They are best suited for growing small grains and native grasses. Adapted crops include

wheat, oats, grain sorghums and cotton. Grasses for pasture or meadow include little and big bluestem, Indiangrass, blue and sideoats grama, switchgrass and buffalograss. Soil improving crops include Austrian winter peas, vetch, sweetclover, mung beans and cowpeas. Most of these can be cut for hay or plowed under as green manure. Alfalfa can be grown on bottomlands not frequently flooded.

The Rolling Plains

The Rolling Plains area comprises an eastern section of the Great Plains in northwestern Texas. The area lies west of the North Central and Grand Prairie areas and extends from the edge of the Edwards Plateau in Tom Green County northward into Oklahoma. It includes a total area of about 24,000,000 acres. It includes the Red Beds and associated reddish soils and this has led to use of the name Red Plains by some.

The surface, as the name implies, is rolling although large flat areas occur in places. The surface is well dissected for the most part, but large nearly level undissected areas occur intermixed with severely eroded sloping areas bordering streams. Several large rivers that head in areas to the west cross this area and have deep valleys with strongly sloping and gullied side slopes and only narrow strips of flat alluvial soils. The most notable is the Canadian River valley which perhaps would be more appropriately called the Canadian River Breaks. Other important rivers are the Red, Pease, Wichita, Brazos, Colorado and Concho.

Rough breaks in the Rolling Plains

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Landscape typical of the western portion of the Rolling Plains - "Caprock" in background comprises eastern boundary of the High Plains.

The native vegetation varies with soils and surface conditions. On the finer textured soils curly mesquite, buffalo and gramagrasses were dominant with some scattered shrubs in places. On the more sandy soils the principal grasses are little bluestem, sideoats grama and threeawn grasses with sand sage and shinnery on areas of deep sand. Severely eroded areas of red beds are bare of vegetation in places and support only patches of buffalograss and curly-mesquite and scattered shrubs in others.

The soils have developed mainly from two kinds of parent materials, (1) red beds clays, and (2) sandy and clayey outwash. The characteristics of the soils vary according to differences in parent materials and topography or slope. The deep normal soils occur only on the nearly level to gently sloping areas. For the most part, soils developed from outwash materials on flat to gently sloping surfaces are of the Abilene, Miles and Roscoe series. These soils range from light brown loamy fine sand to dark grayish brown clay loam or clay in the surface layers and have subsoils ranging from reddish sandy clay loam to dark grayish brown clay. All have the characteristic horizon of carbonate accumulation, caliche, in the lower part of the soil profile. They are about neutral in the upper horizons, but are calcareous in the lower subsoils. Deep soils developed on gentle slopes from red beds are mainly of the Tillman, Hollister and Foard series. These soils have reddish brown to dark brown mostly clay loam surface layers with reddish brown to brown firm blocky clay subsoils. They are noncalcareous in the upper part and underlain by the caliche layer also.

Very shallow and shallow soils on moderate to steep slopes are mainly Vernon soils over red beds, Potter and Mansker over outwash materials or thick beds of caliche. Large areas of the latter occur in the "Canadian Breaks."

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About 40 percent of the soils of the Rolling Plains are of smooth areas of the Miles, Abilene, Roscoe, Tillman, Hollister and Foard series suited for cultivation. The larger proportion, about 60 percent, is of the very shallow and shallow soils of the Potter, Mansker and Vernon series or of rough gullied land unsuited for cropland.

Shallow soils of the Rolling Plains - Grasses are little bluestem, sand bluestem, sideoats grama and hairy grama.

The deep soils of the Rolling Plains are very productive and are not seriously susceptible to erosion because of the nearly level surfaces. Sloping areas of the finer textured soils are very susceptible to water erosion and the deep sandy soils are highly susceptible to wind erosion. On the deep normal soils, cotton and grain sorghums are the principal crops. Wheat is an important crop also on the fine textured soils of the Abilene, Hollister, Tillman and Foard series. Adapted soil improving crops include hairy vetch, sweetclover and Austrian winter peas. Cowpeas can be grown successfully in the eastern part. Alfalfa does well onthe soils of low terraces and in bottomlands. The more important grasses for pasture are little bluestem, sideoats and blue grama, switchgrass, sand bluestem, sand dropseed, sand lovegrass, buffalograss and curlymesquite.

The High Plains Area

The High Plains area comprises the vast high plateau of some 20,000,000 acres in northwest Texas. It lies in the southern part of the Great Plains province which includes large similar areas in Oklahoma and New Mexico. The flat nearly

level surface of very large areas with few streams of any dissection to cause local relief are unique features that are most impressive. Stream dissection is very slight over most of the area, but several major rivers originate in the High Plains or have headwaters in New Mexico and cross the area. The largest of these is the Canadian River which has cut a deep valley across the panhandle section. Small intermittent lakes or playas that lie some 5 to 20 feet below the surrounding flat plain are scattered throughout the area and receive most of the runoff.

The native vegetation is of three distinct kinds. In the northern part and on the fine textures soils south of the Canadian River the vegetation is short grasses, mainly buffalo with some grama. In the southern part on the sandy loam soils it is very largely grama and threeawn. On the deep sands it is mainly little bluestem, sand dropseed, sideoats grama and threeawn-grasses. In places these sands support a thick growth of shin oak and sand sage.

Native vegetation typical of the northern High Plains - Short grasses and sage brush.

The soils have developed from deep beds of friable calcareous water-laid or wind deposited soil materials brought from higher lying western areas. The deep normal soils on flat surfaces have the carbonate horizon (caliche layer) at depths of 2 to 5 feet beneath the surface. This is a characteristic feature of normal soils developed under low rainfall. The soils are of several kinds due mainly to kind of soil parent materials and slope of land on which they have developed. In the northern and central parts the soils are rather dark, mostly clay loam in texture with brown to reddish brown clay subsoils.

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On smooth surfaces they are mainly of the Pullman, Olton, Portales and Zita series. These are deep soils of high productivity when moisture is adequate. On the sloping areas the soils are of the Mansker and Potter series. These are shallow to very shallow calcareous soils mostly unsuited for cropland. In the eastern and southern parts the soils are mainly fine sandy loams and loamy fine sands of the Amarillo series with smaller areas of soils of the Portales, Brownfield and Tivoli series. The Amarillo soils have light brown to reddish brown friable noncalcareous surface layers with reddish brown friable sandy clay loam subsoils. Brownfield soils are more sandy and the Tivoli series is of deep sands. In the southwestern part the soils are sandy with only small areas of other soils included. Brownfield and Tivoli are the main series. Brownfield soils have fine sand surface layers 10 to 25 inches thick with red friable sandy clay loam subsoils. These soils have undulating, billowy or duned surfaces due to wind action and are generally unsuited for cropland.

The Amarillo and Pullman soils are the most extensive and the most important to agriculture of any of the soils of the High Plains. Probably nearly 70 percent of the total area is composed of these soils and the smooth closely associated soils of the Olton, Portales and Zita series. A very high proportion of these soils is suited for cropland. The sandy soils and deep sands of the Brownfield and Tivoli series occupy about 15 percent and other soils the remaining 15 percent of the High Plains area. Only a small percentage of these soils is suited for cropland.

Nearly level area, mostly of Pullman soils on the High Plains - Playa lake near farmstead.

The smooth deep soils of the High Plains are moderately fertile and productive when moisture is adequate. However, because of the low rainfall and erratic distribution, crop yields are often greatly reduced. Wind erosion is a constant hazard on most of the soils. The major problems in crop production center around the water conservation and measures for reducing wind erosion. Deep plowing, contour cultivation, stubble mulch and rough tillage are the most important measures used. A good vegetative cover of either growing crops such as wheat or sorghums, or the dead residue from these crops probably is the most effective single conservation measure. Dead organic matter on the surface reduces the susceptibility of the soil to wind erosion, helps in-

crease the water intake rate, adds organic matter and helps reduce evaporation and soil temperature. The shallow sloping soils and deep sandy soils are poorly suited, or unsuited for cropland and their best use is for native range.

On much of the native rangeland long continued overgrazing, especially during dry years, has reduced the vigor and the stand of desirable grasses. Some areas need to be reseeded, but management that includes proper stocking rates and controlled grazing will restore the stand and vigor of the desirable grasses on most of the rangeland.

The Trans-Pecos Area

The large region of Basins and Mountains in the extreme western part of the state, mainly west of the Pecos River, has been designated as the Trans-Pecos area. This vast area of about 18,000,000 acres is extremeny diverse in character and markedly different from any other part of the state. It consists of high flat plains and valleys or basins intermixed with mountains. The surface of the plains and valleys is nearly level, but some basin areas are depressed. The mountains and rough lands that rise to as much as 5000 feet above the basins within short distances are steep, broken and rugged. Several streams have cut narrow valleys and steep-walled gorges through the area, but many of the basins have no drainage outlet and as a result are salty. The largest of these is Salt Basin in northeastern Hudspeth and northwestern Culbertson Counties.

Mountains and basins are typical of the landscape of the Trans-Pecos resource area.

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The natural vegetation of the Trans-Pecos area is as variable as the topography, soils and drainage conditions. In general it is of two types: short grasses and shrubs on the flat soils of the basins and valleys, and a mixture of mid and short grasses and species of oak, pine, juniper and semi-arid plants and shrubs on the rough and mountainous lands. Alkali sacaton and other salt tolerant plants are common in spots in the basins. The vegetative cover is very thin over most of the area and in many of the basins it is mainly tarbush and creosotebush with scattered patches of tobosagrass.

The soils of the Trans-Pecos area have characteristics that vary according to kind of parent materials and slope of land. Deep soils occur only on nearly level surfaces and most of them are light colored due to low organic matter accumulation under sparse vegetative cover. They have developed from calcareous silty clayey parent materials originally transported by water from the surrounding rough mountainous lands.

Soils of the Reeves, Reagan and Verhalen series occupy the greater portion of the flat valleys, plateaus and basins. These are light colored moderately deep to deep strongly calcareous soils underlain by a thick bed of caliche that contains considerable gypsum in places. The Reeves soils are the most extensive. They have pale brown surface soils, with pale brown subsurface layers over a thick bed of caliche containing much gypsum at depths of about 12 to 24 inches beneath the surface. These are mainly silty clay loams and silt loams and most areas contain many hard caliche fragments of gravel size. Reagan soils are similar in color, texture and reaction but are much deeper, contain few or no caliche fragments and have little or no gypsum in the caliche horizon. The Verhalen soils are reddish brown deep crumbly calcareous clays underlain by beds of igneous gravel at depths between about 10 and 20 feet beneath the surface. Some local depressed areas of each of these soils are salty where surface drainage is totally lacking.

These are the principal arable soils in the area. However, the rainfall is insufficient for crop production and all cropland requires irrigation. These deeper soils together occupy about 60 percent of the entire Trans-Pecos area. Probably nearly half of the area is physically suited for cropland if irrigated.

All cropland in the Trans-Pecos resource area requires irrigation because of low rainfall.

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The rough stony lands group includes all of the stony, rough, broken and mountainous lands of limestone and igneous rock materials. These areas have very little soil development except in crevices and pockets between the rocks. Areas of rough lands of igneous rock materials have a thin to moderately thick stand of grama and other grasses, but limestone areas support only a very thin grass cover. These rough stony lands are suited only for grazing, mainly by cattle. Probably about 30 percent of the entire Trans-Pecos area is occupied by these rough lands that are wholly unsuited for cropland.

Alluvial soils occur in the valleys of the Rio Grande, the Pecos River and a few local streams. These are calcareous soils mainly of the Gila, Glendale, Pecos, Toyah and Balmorhea series. They range from reddish brown to brown or dark grayish brown in color and from silt loam to silty clay loam in texture. Some are salty, but most of them are well suited for cropland if drainage and water for irrigation are provided. The total extent of these soils is very small, probably only about 2 percent of the entire Trans-Pecos area.

A relatively small area of sands and deep sandy soils occurs in the extreme northwestern part of the area east of the Pecos River. These soils are mainly of the Tivoli and Springer series. They are similar to the deep sands of the High Plains and are too sandy for cultivated crop use. The area is conspicuous because of the duned and hummocky surface and the light colored patches that are bare of vegetation and are continually being shifted by the wind. These deep sandy soils occupy about 8 percent of the Trans-Pecos area and are suited only for grazing.

Irrigation is necessary for all cropland in the Trans-Pecos area. Adequate drainage, soil management to add organic matter, increase fertility and improve the structure of the soils, and, of course, efficient use of adequate water for irrigation are the main requirements for cropland. Grazing practices that will allow natural reseeding and increase the desirable forage grasses are practical measures needed on all rangeland. Because of the low rainfall, improvement of native ranges is slow. The most successful method seems to be through natural means aided by use and management.

The Edwards Plateau Area

The Edwards Plateau is a large elevated well dissected limestone plain, or highland, in Central West Texas. The total area is about 22,000,000 acres. The original table-land surface has been largely removed by erosion and many streams that originate in or cross the area have cut deep valleys and produced a hilly and broken topography in many sections. High rolling divides, large areas of smooth tableland remnants and steep walled canyons and gorges occur throughout the area. The slopes range from very gentle to steep and runoff of rainwater is rapid from most of the area. Consequently, most of the soils are very shallow and stony and in many places massive bare limestone is exposed.

The native vegetation throughout the area is variable but is dominantly grasses with various shrubs and scrubby trees in many places. In the eastern and more humid part, brush, tall and short grasses including little bluestem, green sprangletop, grama, threeawn and buffalograss form a thick cover on the deeper soils with an overstory of live oak, post oak, shin oak and mesquite trees. In the central part, the oak trees decrease and mesquite trees and brush are

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more common. The grasses are mainly short grasses that include curlymesquite, buffalo, grama, threeawn and in places tobosagrass. In the western and drier parts, the vegetation is largely semi-arid types and includes much brush and woody plants with little short grass except on deep soils in narrow valleys. A thick growth of juniper (cedar breaks) occurs on many steep rolling slopes throughout the area.

Landscape typical of much of the eastern portion of the Edwards Plateau.

The soils of the Edwards Plateau have developed from limestones or interbedded limestone and chalky marl under a grass cover. Most of the soils are shallow to very shallow and deeply developed soils occur only in small areas on some nearly level plateau remnants or in valleys. Many areas are stony and limestone bedrock outcrops or is exposed on slopes in many places. Rough stony lands with little or no soil covering occur on steep slopes bordering streams and drainage-ways throughout the area.

The soils are dominantly dark, calcareous, granular and of shallow to very shallow depth. In the central and eastern most humid part, the soils are mainly of the Tarrant and Valera series. Tarrant soils consist of 5 to 10 inches of dark gray grayish brown calcareous clay over limestone. Valera soils are similar in the surface layer but have subsurface layers of dark brown to brown crumbly granular calcareous clay over limestone at depths between about 12 and 36 inches beneath the surface. Intermixed areas of other soils mainly of the San Saba, Denton and Crawford series occur also in the most eastern parts. Only small areas of these deeper soils are suited for cultivation. The Tarrant and Valera soils together with other soils over limestone occupy about 60 percent of the entire area of the Edwards Plateau

In the western and drier parts the soils are mostly shallow and stony, but some deep soils occur also. These shallow soils are mainly of the Ector series. The deeper soils are mainly of the Tobosa and Ozona series. The Tobosa soils are of dark grayish brown calcareous clay with subsurface layers of dark brown to dark grayish brown firm blocky clay. Ozona soils are somewhat similar to the Valera soils but are lighter colored, more crumbly and granular throughout. Both the Tobosa and Ozona soils are underlain by limestone at depths between about 2 and 4 feet beneath the surface. These soils together

with areas of rough stony land occupy about 30 percent of the Edwards Plateau area.

Vegetation and soils of the extreme western portion of the Edwards Plateau reflect the dry climate.

In the Northwestern part of the Edwards Plateau, mainly in Reagan and Upton Counties, there is an appreciable area of medium depth and deep soils developed in outwash materials. These soils are of the Reagan and Reeves series and are similar to soils of the Trans-Pecos area discussed in a following section. They occupy about 10 percent of the area.

Because of the high proportion of shallow and stony soils, only a small part of the Edwards Plateau area is suited for cropland. Less than about 3 percent is now used for cultivated crops and probably less than 12 percent of the entire area is suited for any kind of cultivated cropland. Most of the arable land in the central and western parts will require irrigation for successful crop production.

The Edwards Plateau area is an important livestock producing section of the state. The relatively dry climate and nutritious grasses produced on the calcareous soils are very favorable for cattle, sheep and goats. However, because of the generally sloping surfaces, thin soils and sparse vegetation, much of the rainwater is lost as runoff. Conservation and management practices that will increase the grass cover on grazing lands are needed for conserving much needed moisture. Some areas will require reseeding, but deferred use followed by controlled grazing will be sufficient for most areas. Uniform grazing can be obtained by fencing and distribution of salt and watering places. The control of weeds, especially bitterweeds, and of woody plants and brush is needed throughout most of the Edwards Plateau. The lack of moisture is the main limiting factor in crop production on the arable soils. Any measures that

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will reduce water runoff, add organic matter, improve soils structure and increase the water intake rate of the soils will be beneficial. Drought resistant crops including sorghums, Sudan and Johnsongrass and small grains are the most adapted.

Rio Grande Plain Area

The Rio Grande Plain comprises the large wedge shaped area that includes the extreme southern and southwestern parts of Texas. This is a large undulating to gently rolling plain of some 22,000,000 acres.

The area has a gentle slope to the southeast. Several small rivers cross the area and local tributary streams provide drainageways for local runoff water except in a few sections. For the most part, streams have shallow valleys and the surface relief is much less extreme than that of the Edwards Plateau which forms the north boundary of this area. Locally, the surface ranges from nearly level in large areas to moderately sloping in small parts of the interior.

Vegetation varies with soils and slope of land, but in general is dominated by plants common to climatic conditions of high temperatures and low rainfall. Small mesquite trees are common over most of the area and oak trees are rather thick in parts. Various thorny shrubs, commonly included in the general term "chaparral" form a thin to thick cover in the central and southern parts. Pricklypear is thick in places. Bunch grasses, including species of andropogons, grama, threeawn, panicum, green sprangletop and tanglehead, grown on the sandy soils and buffalo, curlymesquite and some species of grama form a thick cover on the clay soils. Stream bottoms have a thick cover of oak, mesquite, hackberry, elm and other trees.

Mesquite, "chapparal" and pricklypear are thick over a large area in the central and southern parts of the Rio Grande Plain.

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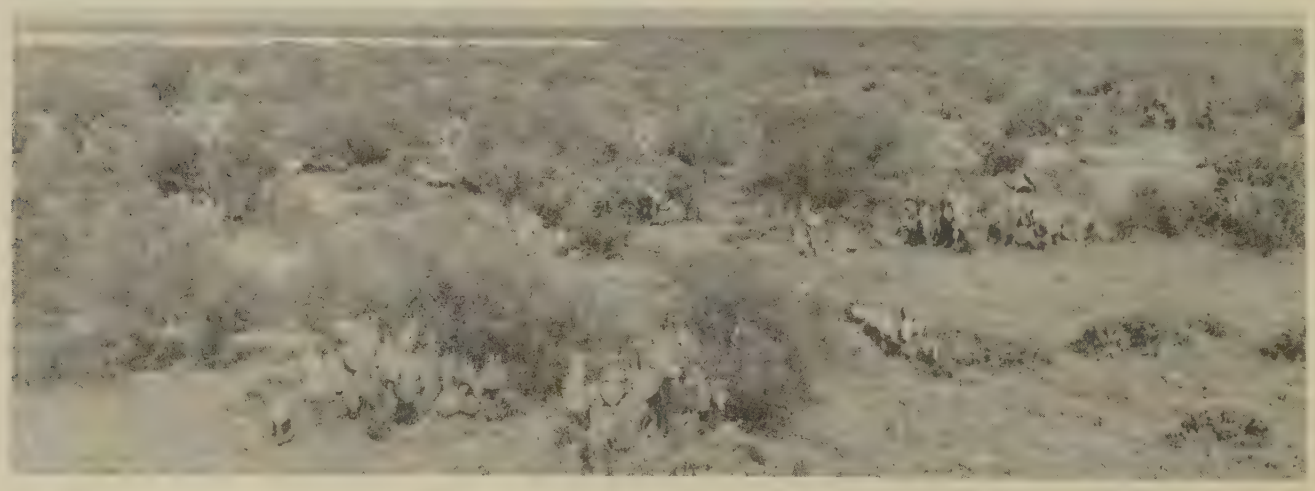
The soils occur in several rather distinct areas or subdivisions characterized by contrasting kinds of soils, vegetation and topography. They have developed from two general kinds of parent materials: (1) calcareous clays, marl or other limy material and (2) beds of non-calcareous clay and sandy materials. The normal soils, for the most part, are underlain by the caliche layer characteristic of soils developed under low rainfall. In places this layer is near the surface and where exposed by erosion is hard and rock-like. On the basis of soil characteristics, vegetation and relief, the soils fall naturally into several distinct kinds which are discussed below.

In the northeastern part in the vicinity of Corpus Christi, there is a large nearly level to gently undulating area of dark gray to black clayey soils. This section, locally called the Coastal Bend, is the southwestern extension of the Coast Prairie. The soils are mainly of the Victoria, Orelia and Clareville series. These are deep fertile soils that total about 3,000,000 acres. They are very productive when moisture is adequate and comprise the largest area of cultivated soils in the Rio Grande Plain.

In the north central part the soils range from light colored sandy loams to dark gray clays. The surface is undulating to gently rolling and shallow soils occur on the more sloping areas. The principal soils are of the Goliad, Monteola and Zapata series in the central and northern parts and Maverick, Uvalde and Montel series in the northwestern parts. A small area of deep sandy soils, mainly of the Medio and Nueces series, occurs in the northeastern part. Only the deeper soils, mainly of the Monteola, Uvalde and Montel series, are used for cropland. The total area of these soils is about 9,000,000 acres.

In the south central part the soils are dominantly light colored sandy loams and loamy sands. They have light brownish gray to reddish brown surface layers with subsoils of reddish sandy clay to clay loam. The principal series are Webb, Duval, Delmita, Crystal and Goliad. Large areas of deep sands and sandy soils, mainly of the Brennan, Medio and Nueces series, occupy the more southernly parts. These are undulating to gently rolling soils largely used for grazing. The total area of these soils is about 8,500,000 acres.



Landscape of the gently rolling south-central part of the Rio Grande Plains.

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In the extreme southern part, commonly referred to as the Lower Rio Grande Valley, a large nearly level delta comprises an area of about 1,500,000 acres. The soils are dominantly dark and range in texture from fine sandy loams to heavy clays, Surface drainage is slow but internal drainage is adequate for crops except in local areas and near the coast. The principal soils are of the Willacy and Hidalgo series on the "upland" and Harlingen, Cameron and Uvalde series in the bottomland of the Rio Grande. These are the principal irrigated soils on which vegetables, citrus and cotton are produced. A large proportion is irrigated, but a considerable area is dryland farmed mainly to cotton. Along the coast there is a strip several miles wide of wet mostly salty soils mainly of the Lomalta series. They are covered with water loving and salt tolerant plants and are used entirely for grazing by cattle.

Citrus orchard - lower Rio Grande Valley. Note irrigation waterline along border.

A very large proportion of this vast area is used for grazing. The principal cultivated sections are the Lower Rio Grande Valley and the Coastal Bend, but smaller areas of some soils of other sections are used for cropland also. In much of the central and western parts, the rainfall is too low for successful dryland farming except on some of the deeper soils. Supplemental irrigation is needed for satisfactory crop yields in all but the most eastern sections. Additional sources of water for irrigation need to be developed. Conservation needs for cropland include management for saving and storing all the rainfall, crop rotations for increasing the organic matter content and structure of the soils, erosion control measures on the more sloping and sandy soils, and drainage in local areas. Brush control reseeding and regulated grazing to allow desirable grasses to become reestablished and controlled grazing thereafter are the main conservation need for native rangeland.

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The Central Basin Area

The Central Basin, also known as the Llano Basin, occupies a relatively small area in central Texas. It lies slightly lower than the surrounding Edwards Plateau, hence the name Basin. The area occupies parts of all of Llano, Mason, Gillespie and parts of adjoining counties. The total area is 2,000,000 acres.

The surface of the area in general is rolling to hilly. A few small smooth valleys and gently rolling divides are intermixed with the hills and rough stony lands. The area is surrounded by high limestone hills and deep valleys extend from these through the basin. Isolated remnants of the Edwards Plateau occur in parts of the Basin and form high hills with steep stony slopes. Stony rough and hilly areas of crystalline rocks also occur. Several rivers cross the area and these together with many local tributaries rapidly remove surface water.

Rough stony slopes are common in the Central Basin.

The native vegetation is grass and small oak and mesquite trees. On some rocky slopes juniper forms the principal growth. The grasses form a thick stand where the tree and brush cover is thin or open. Both tall bunch and short grasses and various shrubs furnish very nutritious grazing and browse for livestock.

The soils of the Central Basin have developed from parent materials formed from the weathering of limestone, sandstone or crystalline rocks of granite, gneiss

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and schist. The soils developed from limestone materials are shallow and stony and are quite similar to the soils of the Tarrant, Brackett and Crawford series developed over like materials in the Edwards Plateau. Most of these are very shallow and stony and unsuited for cultivation. The soils developed from crystalline rock materials and sandstone are the most extensive in the area. These are mostly noncalcareous soils that are more or less reddish and of shallow to medium depth. Some are gravelly and stony. The principal series are Tishomingo, Pontotoc, Pedernales and Harley. The Tishomingo soils have gravelly reddish brown sandy loam surface layers with thin subsoils of red gravelly clay over partly weathered granite, schist and gneiss. These are shallow soils and only small areas are suited for cropland. The Pontotoc soils have reddish brown friable surface layers of loamy fine sand to sandy loam over subsoils of red to reddish brown sandy clay loam. Red ferruginous sandstone lies at shallow depths, usually less than 3 feet. Some areas are stony, but most areas contain few or no stones and are suited for cultivation. Pedernales soils are somewhat similar to the Pontotoc soils but are deeper. They have developed from beds of interbedded limestone and sandstone and occur in gently sloping valleys. These soils are largely suited for cultivation and most of the cropland in the Basin is of these soils. The Harley soils are of slight extent. They have subsoils of yellow or mottled yellow and light gray firm plastic sandy clay. The deeper soils are suited for cropland but many areas are shallow and gravelly or stony and suited only for grazing.

These soils occupy about 60 percent of the entire area of the Central Basin. The remainder is occupied by soils of the Tarrant, Crawford and Brackett series and rough stony areas of crystalline rocks. Not a very high proportion of the area is of soils suited for cropland. Probably no more than 15 percent can be used for any kind of cultivated crops. Adapted cultivated crops include grain, sorghum, Sudangrass, oats, peanuts, cotton, corn and cowpeas. Green manure crops include vetch, Austrian winter peas and sweetclover. Peaches are an important tree fruit crop in local areas.

The area is primarily a livestock producing section and most agricultrual operations center around this enterprise. Effective range management that includes brush control, proper range use and deferred grazing are the major conservation needs for rangeland. Water conservation to reduce runoff and erosion and the increase of organic matter and fertility are the major needs for cropland.

Bottomlands

The Bottomlands include the alluvial soils occurring along the major flowing rivers, which include the Brazos, Red, Trinity and Colorado. It extends up the Red to Dennison Dam, up the Trinity to the Navarro County line, up the Brazos to a mid-point in McLennan County and up the Colorado to Austin, and comprises about 2,284,000 acres.

The surface relief is subdued, generally sloping to the east and south with only the short sharp slopes between benches to break the broad sweep of the alluvial plain. Areas of undulating and dissected soils occur where overflows are frequent.

The Bottomlands may be divided into first bottoms which overflow frequently

except where dams or levee systems protect the land from overflow, and the higher lying second bottoms or terraces which are above ordinary overflow.

The native vegetation is mainly hardwood trees even in the most westerly extension because of the extra water received due to a favorable position. However, because of the high fertility of the soils, most of the Bottomlands has been cleared and is cultivated or used for pasture. Only where overflows are frequent does the native stand of hardwood remain.

Pasture on Bottomlands site - Telegraph sub-station built high above ground for protection from frequent overflows.

Soils of the Bottomlands in the Brazos, Red and Colorado river valleys differ from the soils of the other resource areas in that they are not derived from the surrounding upland materials. In spite of the geographical separation of the three rivers, the soils found in their flood plains are very similar due to the common origin of their sediments in the highly calcareous, red beds of the Rolling Plains. Soils of the Miller, Yahola, and Norwood series occur in the flood plains of all three rivers. Smaller quantities of Pledger, Trinity, Frio, Brewer, Portland and Perry also occur in the flood plains. Low benched terraces or second bottoms of Asa, Teller, Reinach and Bastrop occur on all three of the river bottoms.

Soils of the Trinity differ significantly from those of the other Bottomlands in that they are darker, generally more clayey and much more subject to overflow. Levee systems have been constructed to protect cultivated land. The soils are generally calcareous and very fertile but internal drainage is slow.

The soils of the Bottomlands have many common characteristics. They are alkaline to calcareous, mostly brownish to reddish and are youthful in their

development. Small acreages of coarse sands are found with the main body of the soils ranging from fine sandy loams to clays. The soils are very deep and gully erosion is a problem where concentrations of water are discharged over a sharp bank or slope.

Due to their favorable position and high fertility, soils of the Bottomlands are used in growing a variety of crops, including cotton, corn, grain sorghum, alfalfa, truck crops and improved pastures.

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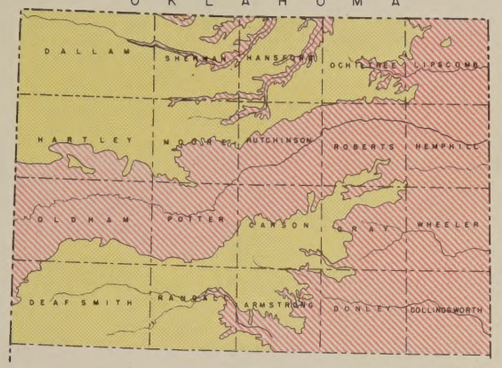

LAND RESOURCE AREAS
STATE OF TEXAS

SCALE 10 0 10 20 30 40 50 60 70 Miles

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

LEGEND

- High Plains
- Trans-Pecos
- Edwards Plateau (Semi-arid)
- Edwards Plateau (Sub-humid)
- Edwards Plateau (Transitional)
- Rio Grande Plain
- Rolling Plains (East)
- Rolling Plains (West)
- North Central Prairies
- West Cross Timbers
- Grand Prairie
- Blackland Prairies
- Coast Prairie
- East Texas Timberlands
- East Texas Timberlands (Redland area)
- East Texas Timberlands (Flatwoods)
- East Cross Timbers
- Bottomlands
- Coast Marsh
- Central Basin

Base map by U.S.D.A. Soil Conservation Service, adapted from 1:500,000 Scale polyconic projection map issued by U.S. Geological Survey. Rev. 11-60 r.m. 4-R-786

6-12-50 J.B.L. Base 4-R-7